

WHAT IS CLAIMED IS:

1. A method of introducing at least one *in situant* into an oil or lubricant of a vapor compression system for the purpose of detecting leaks in the vapor compression system components, comprising the steps of:

- dissolving the at least one *in situant* in a carrier fluid of pure polyol ester oil or a polyol ester oil and alcohol solution,

- delivering the at least one *in situant* and the carrier fluid into a vapor compression system fluid,

- leaving the *in situant* dissolved in the combined carrier/system fluid solution, and

- removing any immiscible or slightly miscible components of the carrier fluid from the system fluid, thereby leaving the miscible carrier fluid components and at least one *in situant* dissolved in the system fluid.

2. The method of claim 1, further comprising the step of delivering an amount of the at least one *in situant* into the system in concentrations of up to the solubility limit of the at least one *in situant* in the system fluid.

3. The method of claim 1, wherein the at least one *in situant* comprises at least one compound which is soluble in the system fluid and the carrier fluid and has fluorescent properties.

4. The method of claim 1, wherein the at least one *in situant* comprises at least one organic compound that emits color in the visible spectrum.

5. The method of claim 1, wherein the at least one *in situant* comprises at least one fluorescent compound and at least one organic compound which emits color in the visible spectrum.

6. The method of claim 1, wherein the system oil or lubricant comprises at least one of polyalkylene glycol, polyol ester, mineral oil and alkylbenzene.

7. The method of claim 1, wherein one or more coumarin compounds are used with the at least one *in situant*.

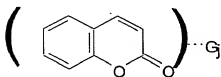
8. The method of claim 1, wherein the carrier fluid comprises at least one of ethanol, methanol, and 2-propanol in solution with polyol ester oil.

9. The method of claim 1, wherein the at least one *in situant* comprises a heterocyclic molecule comprising at least one cyclic group comprising C, H, halogens, S, N, and O.

10. The method of claim 1, wherein the at least one *in situant* comprises a molecule comprising at least one cyclic group comprising C, H, halogens, S, N, and O.

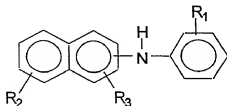
11. The method of claim 1, wherein the at least one *in situant* comprises an organo-metallic compound.

12. The method of claim 1, wherein the at least one *in situant* is used in combination with one or more compounds selected from the group consisting of coumarin and derivatives thereof shown by the following structure,



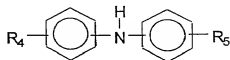
wherein G represents groups comprising C, H, halogens N, and j is greater than or equal to 0.

13. The method of claim 1, wherein the at least one *in situant* is selected from the group consisting of phenylnaphthylamines shown by the following structure,



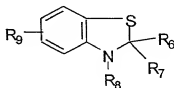
wherein R₁, R₂, and R₃ are groups comprising at least one of C, H, halogens, N, S, and O in cyclic or acyclic structures.

14. The method of claim 1, wherein the at least one *in situant* is selected from the group consisting of diphenylamines shown by the following structure,



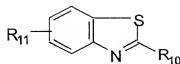
wherein R₄ and R₅ are groups comprising at least one of C, H, halogens, N, S, and O in cyclic or acyclic structures.

15. The method of claim 1, wherein the at least one *in situant* is selected from the group consisting of benzothiazolines shown by the following structure,



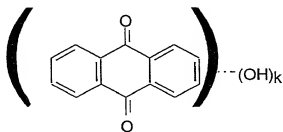
wherein R₆, R₇, R₈ and R₉ are groups comprising at least one of C, H, halogens, N, S, and O in cyclic or acyclic structures.

16. The method of claim 1, wherein the at least one *in situant* is selected from the group consisting of benzothiazoles, shown by the following structure,



wherein R_{10} and R_{11} are groups comprising at least one of C, H, halogens, N, S, and O in cyclic or acyclic structures.

17. The method of claim 1, wherein the at least one *in situant* is selected from the group of polyhydroxy-anthraquinone compounds where k is greater than or equal to one with the structure:



18. The method of claim 1, wherein the at least one *in situant* is an oil or lubricant additive selected from the group consisting of anti-oxidation, anti-wear, anti-friction, dispersion improvement, and viscosity index improvement additives.

19. A leak detection method, comprising the steps of:

- introducing a compound selected from the group consisting of organo-metallic *in situant* compounds comprising molecular groups comprising at least one of C, H, halogens, N, S, and O in

cyclic or acyclic structures and at least one metal into a refrigeration system comprising a fluid system; and

- causing the compound to fluoresce at any point in the system where there is a leak.

20. The method of claim 19, wherein the step of introducing the *in situ* compound into the system is effected in concentration up to the solubility limit of the compound in the system fluid.

21. The method of claim 19, wherein the system oil or lubricant comprises at least one of polyalkylene glycol, polyol ester, mineral oil and alkylbenzene.

22. The method of claim 19, wherein the step of introducing comprises dissolving the compound in a carrier fluid, delivering the compound and the carrier fluid into the system, and removing immiscible components of the carrier fluid from the system fluid.

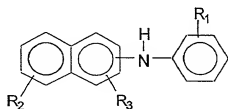
23. The method of claim 22, wherein the carrier fluid comprises an alcohol in solution with polyol ester oil.

24. The method of claim 22, wherein the carrier fluid comprises at least one of ethanol, methanol and 2-propanol in solution with polyol ester oil.

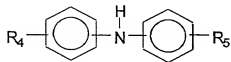
25. A leak detection method comprising the steps of:

- introducing an *in situant* capable of fluorescing into a refrigeration system comprising a system fluid; and

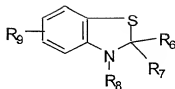
- causing the compound to fluoresce at any point in the system where there is a leak, wherein the compound is soluble in the system fluid and comprises at least one of phenylnaphthylamines:



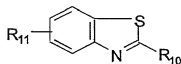
where R_1 , R_2 , and R_3 are groups comprising at least one of C, H, halogens, N, S, and O in cyclic or acyclic structures; dialkyldiphenylamines:



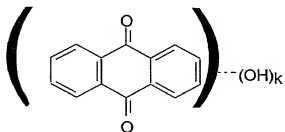
where R_4 and R_5 are groups comprising at least one of C, H, halogens, N, S, and O in cyclic or acyclic structures; organometallic compounds comprising molecular groups comprising at least one of C, H, halogens, N, S, and O in cyclic or acyclic structures in combination with at least one metal; benzothiazolines:



where R_6 , R_7 , R_8 and R_9 are groups comprising at least one of C, H, halogens, N, S, and O in cyclic or acyclic structures; benzothiazoles:



where R_{10} , and R_{11} are groups comprising at least one C, H, halogens, N, S, and O in cyclic or acyclic structures; and a group of compounds derived from the polyhydroxy-anthraquinone structure with k greater than or equal to 1:



26. The method of claim 25, wherein the step of introducing the *in situant* compound into the system is effected in concentrations of up to the solubility limit of the compound in the system fluid.

27. The method of claim 25, wherein one or more coumarin compounds are used in combination with an *in situant* compound.

28. The method of claim 25, wherein the system oil or lubricant comprises at least one of polyalkylene glycol, polyol ester, mineral oil and alkylbenzene.

29. The method of claim 25, wherein the step of introducing comprises dissolving the compound in a carrier fluid, delivering the compound and the carrier fluid into the system, and removing immiscible components of the carrier fluid from the system fluid.

30. The method of claim 29, wherein the carrier fluid comprises at least one of ethanol, methanol and 2-propanol in solution with polyol ester oil.

31. A method of detecting leaks in a refrigeration system comprising a fluid system, comprising the steps of introducing a fluorescing in situant compound into the fluid system and detecting the leak with a UV lamp.

32. The method of claim 31, wherein the UV lamp is a xenon flash tube.

33. The method of claim 32, wherein the xenon flash tube comprises a quartz glass.

34. The method of claim 32, wherein the xenon flash tube is filled with a xenon gas mixture at a pressure of less than about 4 atmospheres.

35. The method of claim 32, wherein the xenon flash tube comprises a trigger circuitry means for obtaining an adjustable or a preset flash rate.

36. The method of claim 35, wherein the means produces a flash rate from about 4 flashes per second to about 1 flash every four seconds.

37. The method of claim 32, wherein the xenon flash tube comprises a filter glass with a high degree of internal transmittance in the 180 to 390 nm ultraviolet wavelength range.

38. The method of claim 32, wherein the xenon flash tube comprises an ultraviolet flash pulse circuit.

39. A flashing UV lamp, comprising a xenon flash tube, a trigger circuitry means for obtaining an adjustable or a preset flash rate, and a filter glass.

40. The flashing UV lamp of claim 39, wherein the xenon flash tube is filled with a xenon gas mixture at a pressure less than about 4 atmospheres.

41. The flashing UV lamp of claim 39, wherein the xenon flash tube comprises an UV flash pulse circuit.

42. The flashing UV lamp of claim 39, wherein the mean produces a flash rate from about 4 flashes per second to about 1 flash every four seconds.

43. The flashing UV lamp of claim 39, wherein the filter is applied directly to the xenon flash tube.

44. A composition comprising a carrier fluid and an *in situant*, wherein the carrier fluid comprises a polyol ester oil or polyol ester oil-alcohol solution and wherein the *in situant* is soluble in the carrier fluid and is selected from the group consisting of anti-oxidation, anti-wear, anti-friction, dispersion improvement, and viscosity index improvement compounds.

45. A method of introducing N-phenyl-1-naphthylamine into an oil or lubricant of a vapor compression system for the purpose of detecting leaks in the vapor compression system components, comprising the steps of:

- dissolving the N-phenyl-1-naphthylamine in a carrier fluid of pure polyol ester oil or a polyol ester oil and alcohol solution,

- delivering the N-phenyl-1-naphthylamine and the carrier fluid into the vapor compression system fluid,

- leaving the N-phenyl-1-naphthylamine dissolved in the combined carrier/system fluid solution, and

- removing any immiscible or slightly miscible components of the carrier fluid from the system fluid, thereby leaving the miscible carrier fluid components and N-phenyl-1-naphthylamine dissolved in the system fluid.

46. The method of claim 45, wherein said dissolving further comprises dissolving one or more coumarin compounds or one or more additional *in situ*ants in the carrier fluid.